

Nomination of the
SECOND COAL LOADING BERTH
PORT OF HAY POINT
for
ENGINEERING HERITAGE RECOGNITION
under
Engineering Heritage Australia's
Heritage Recognition Program.

Submitted by

Engineering Heritage Australia (Queensland
Panel).

Prepared for EHA(Q) by Panel members

Paul D. Coghlan & Brian L. McGrath,

*With major technical input from the project engineering
director*

Alastair Eddie.

BASIC DATA

| | |
|----------------------------------|--|
| Item Name: | Coal Loading Berth No. 2, Port of Hay Point |
| Location: | Port of Hay Point, Queensland 149°19'E 21°15'S |
| Nearest City: | Mackay |
| Nearest Town: | Sarina |
| State: | Queensland |
| Local Government Area: | Mackay Regional Council |
| Port Authority: | North Queensland Bulk Ports Corporation |
| Owner: | Present Owner: BHP Billiton Mitsubishi Alliance Original Owner: Utah Development Company |
| Current Use: | Loading Export Coal |
| Design Firm: | Rendel and Partners * |
| | Design Supervision: Alastair Eddie (Director of Engineering) & Alex Macknight (Project Engineer) |
| | Contract Constructors: Joint Venture Christiani & Neilsen of South Africa and John Holland of Australia * |
| Year Started: | 1972 |
| Year Completed: | 1975 |
| Physical Description: | Offshore prestressed concrete caisson berth, fabricated in one port (Port of Mackay) and erected in another (Port of Hay Point). |
| Physical Condition: | Good operating condition |
| Modification & Dates: | Fender system upgraded for 250,000 tonne ships in 1995 |
| Heritage Listings: | Nil |

- *Refer Appendix 1 for the Project Design and Construction Report, prepared by Alastair Eddie.*

History

In the early 1960s, the Utah Development Company selected Hay Point, about 25 sea-miles south of Mackay, as the site to construct an open sea berth with trestle access to export coal from its mines in the Upper Bowen Basin of Queensland.

In 1971, coal exports from the Goonyella Mine commenced over Hay Point No. 1 berth. With the development of additional mines, a second coal-loading jetty was required.

Based on the experience already gained with construction of No. 1 berth, it was considered that there would be significant inherent risks of weather delays in constructing a second offshore conventional piled berth adjacent to No. 1 Berth. It was realised also, that prolonged construction work in close proximity to the operating No. 1 Berth could potentially jeopardise the smooth flow of coal for export. For this reason, it was a requirement that the access trestle to No.1 berth could not be used for construction of No. 2 berth. Finally, in such an open sea location, a “stick-build” structure immediately adjacent to an operating berth, would be vulnerable to accidents resulting in damage to the structure under construction, and/or the ships approaching or departing No.1 berth.

Therefore the owners, Utah Development Company (UDC), instructed the designers, Rendel and Partners, to prepare a concept for a berth structure that could be built elsewhere and installed in a very short time at the location of the second berth. This required almost 100% offsite prefabrication followed by floating and sinking the prefabricated units, limiting onsite work to a few days rather than an extended 2-3 year period.

The concept was developed with the cooperation of Professor Ben C. Gerwick of San Francisco who was working at the time on the first offshore concrete oil production platforms in the North Sea.

The adopted scheme comprised the construction and fitting out of three large prestressed concrete caissons in Mackay Harbour. The caissons were constructed in a specially built dry dock and floated to the site under their own buoyancy **. They weighed up to 30,000 tonnes.

The caissons were of semi-submersible configuration, with the caisson base submerged and only the columns protruding above the water so as to minimise wave loads during the tow and while being sunk to the prepared foundation***. Each caisson carried the berth deck and coal loading equipment from Mackay Harbour to Hay Point.

*** Refer Appendix 2 for photographs of the project, including the tug towing a completed caisson with shiploader from Mackay Harbour.*

**** Refer Appendix 3 for more details of the project, with particular reference to the pre-stressing.*

The caissons were set down on the prepared foundation beds and joined by intermediate crane beams. Weather downtime was negligible.

A further major factor in the concept development was the ability to assemble and commission the coal loader (weighing approximately 1200 tonnes) on top of one of the caissons in Mackay Harbour, thus avoiding the risks inherent in assembling such a large machine over water in exposed sea conditions.

Five smaller caissons provided the foundation for the extension of the offshore access road and conveyors. Two other smaller caissons formed the mooring dolphins.

For the trestle extension, steel trusses of 75m span were fabricated alongside the temporary dry dock at Mackay and lifted into position at Hay Point using a purpose built shearlegs floating crane of 175 tonnes capacity. Each truss was fabricated complete with roadway and conveyor before being taken by barge to Hay Point.

The project was commissioned in 1975 and continues to operate in 2012, well beyond its design life, servicing ships well above the original design capacity.

Assessment of Significance

Historic Phase

The novel concept for No.2 coal export berth at the Port of Hay Point arose in 1971/72, in what were still relatively early days of the modern Australian coal export trade. The concept, to pre-fabricate a major export wharf for an open sea location in a sheltered port environment and float it to the site for installation, was born from consideration of several critical constraints occasioned by the open-sea site and the adjacent operating No. 1 berth. The use of concrete caissons in such circumstances was also in its early days.

Historic Association

The design work for the Hay Point No. 2 Berth project was carried out by Rendel & Partners in Brisbane, supervised by Alastair Eddie (Director of Engineering) and Alex McKnight (Project Engineer).

The details of the design were developed with continued cooperation of the late Professor Ben Clifford Gerwick of San Francisco. Professor Gerwick was a civil engineer and university professor of University of California at Berkley, famous in his field for his role in developing the high-strength concrete underpinnings needed to support the world's deepest offshore oil platforms and longest suspension bridges. Professor Gerwick passed away in 2006 ****

Creative/Technical Achievement

The Hay Point No 2 Coal Loading Berth is an outstanding engineering work both in concept and execution with the construction of the caissons, superstructure and coal loader in Mackay Harbour, and the subsequent floating and erection of the segments at the Port of Hay Point. The majority of the work was carried out on solid land at Mackay Harbour with minimum work in the open sea.

No such work had ever been attempted in Australia prior to this project. Indeed the use of floating concrete structures for incorporation in open-sea offshore works was then in its infancy.

Research Potential

The successful design, construction and installation of the Port of Hay Point No. 2 berth introduced a new concept in the design of offshore structures to Australia. It demonstrated procedures that could be utilised in similar situations both in this country and overseas.

Social Relevance

Every citizen of this country – and many worldwide - are aware today of the value and importance of Australia's coal export trade to the country's Balance of Payments and, by providing coal for industry and electricity generation, of its contribution to the increasing quality of life of people in developing countries.

The successful design and construction of the No.2 coal export berth at the Port of Hay Point in the early 1970s was a significant development in Australia's coal export trade, thus contributing social benefits both to this nation and to those overseas countries which need and receive our coal exports. A total of over 500million tonnes of coal has been exported over No. 2 Berth since 1975, a staggering figure.

****for a short biography/obituary on Professor Gerwick, go to
http://berkeley.edu/news/media/releases/2007/01/09_gerwick.shtml

Rarity/Representativeness

At the time of its design and construction, the Hay Point No. 2 coal export berth represented a world-first solution to the task of constructing a major ship berth in the open sea.

The situations where such conditions prevail are – and indeed are understandably likely to be – rare. In Australia at the present time, a similar approach has been taken for the design and construction of an export wharf in the open sea on the Western Australian coast. Construction work on this project, involving the placement of concrete caissons for the berthing and mooring dolphins and the loading berth proper, has commenced.

The two projects are structurally similar, but a unique feature of Hay Point is that the ship loading equipment was assembled and commissioned onshore and transported to site on-board the caissons.

Integrity/ Intactness

The No. 2 coal export berth at the Port of Hay Point is still operating at full capacity after almost 40 years, beyond its initial design life.

Statement of Significance

The No. 2 coal export berth at the Port of Hay Point is of significance to port, harbour and offshore engineering, both in this country and abroad.

Difficult site constraints relating to the open sea site and potential for weather delays to construction, the impracticability and ineconomies of using the trestle serving No. 1 berth for the construction access, the need to avoid risk of damage to the structure and/or shipping operating from No. 1 berth, led to a new, practical and economic design and construction for No. 2 berth.

The engineering significance was the development of the technology of floating concrete caissons to form the foundation of the offshore structure.

The proximity of Mackay Harbour to the site for the No.2 berth and the availability of a sheltered site there to construct caissons, coupled with the site constraints listed above, led to this world-first design, which proved not only feasible, economic and practicable in the construction phase of the project, but also produced a structure which has been operationally sound and relatively maintenance-free for almost 40 years.

It has made a significant contribution to the economic well-being of people of the State of Queensland, citizens of other Australian States, and to the social as well as economic well-being of people in overseas countries by its important role – in both the early years of the trade and up to the present day - in facilitating Australia's export coal trade.

Both the design phase and the construction phase of this project, as well as the project's owners, represented both Australian and international interests. The coal that is exported across Hay Point Port No. 2 coal berth travels to many international destinations.

It is a successful project with international significance.

Information Panel Content Outline

- World's first offshore prestressed concrete caisson berth.
 - Caissons and superstructure fabricated in a purpose-built dry dock and fitting-out jetty in Mackay Harbour.
- Caissons complete with superstructure - including the shiploader - towed 25 sea-miles to the Port of Hay Point and sunk to a prepared seabed in position to form the berth.
- This novel approach had a number of benefits, including
 - *****Limiting weather delays at the open sea site
 - *****Avoiding interference with coal-loading operations at the adjacent operating trestle & berth
 - *****Avoiding accident risks from ships approaching or leaving the existing operating berth.
- International Aspects in ownership, design, construction and ongoing operation.
- Designed and Constructed: 1972 – 1975
- Commissioned by: Utah Development Company
- Owners Engineer Representative in Design Office: John McRobert
- Designers: Rendel & Partners, Brisbane; Alastair Eddie (Director of Engineering) and Alex Macknight (Project Director), with the cooperation of and input from Ben C. Berwick, San Francisco.
- Contractors: Joint Venture of Christiani & Nielsen of South Africa (Engineers Uffe Hansen, Neil Hodge) and John Holland Australia (Engineers Geoff Cook, Geoff Curnow)
- 2012 Owners: BHP Billiton Mitsubishi Alliance

Possible Illustrations

Figure 15 *Mackay Harbour construction site.* In Appendix 1 and Appendix 2.

Figure 20 *Largest caisson under Tow.* In Appendix 1.

Figure 26 *The completed Berth.* In Appendix 1.

Artists Impression, to illustrate the underwater nature of the berth with cut-away section of one caisson showing prestressed concrete panels. (Yet to be prepared).

Logos of EA, BMA, & heritage disc.

List of Appendices

Appendix 1 *Design and Construction of the Second Coal Loading Berth at Hay Point, Queensland, 1972 – 75.*

A Report prepared in 2011/12 by Alastair Eddie, the Project Director of Engineering, for the Queensland Engineering Heritage Panel's Heritage Recognition Submission.

Appendix 2 Extract (Pages 62 and 63) from *The Mackay Harbour Story*, copyright 1978, Mackay Harbour Board.

Appendix 3 *Floating Concrete Structures, Examples from Practice, Second Printing, July 1992, pps 17,18.*
Published by VSL International Ltd, Berne, Switzerland.

Appendix 4 *Agreement to Nomination from project owner.*
Email from BMA Acting General Manager dated 6 July 2011.

Appendix 1

Design and Construction of the Second Coal Loading Berth at Hay Point, Queensland, 1972 – 75.

A Report prepared in 2011/12 by Alastair Eddie, the Project Director of Engineering, for the Queensland Engineering Heritage Panel's Heritage Recognition Submission.

Appendix 2

The Mackay Harbour Story, (pages 62 & 63).
Copyright 1978, Mackay Harbour Board.

Appendix 3

Pages 17 and 18 of the Publication,
Floating Concrete Structures, Examples from Practice, Second Printing,
July 1992.
VSL International Ltd, Berne, Switzerland

Appendix 4

Owner BMA's Email Agreement to the Nomination

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Joan Coghlan

From: Power Dave DJ (Hay Point)" <Dave J Power@BHPBilliton.com>
To : <pcog0267@bigpond.net.au>
C.c.: "Regan, Cheryl E" <Cheryl.E.Regan@bmacoal.com>
Sent: Wednesday, July 06, 2011 4:23 PM
Attach: img-615150202-0001.pdf; Picture (Device Independent Bitmap) 1 jpg
Subject: Engineering Heritage Award nomination - Hay Point Berth

Paul,

Sorry for the delay in us responding regarding our acceptance of the Engineering Heritage award nomination for our Berth 2 facility design and construction. The delay was in getting legal and Senior Management sign off prior to this approval. The result is that we would be please to accept this nomination. Initially it would be best to deal directly with myself on any consultation for this submission and depending on the time commitment I may get our Engineering Team to assist.

Regard

Dave Power

Acting General Manager - Hay Point Coal Terminal, BMA. Metallurgical Coal

BMP Billiton Mitsubishi Alliance

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7/21/2011